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STRESS, CONFIDENCE, PERFORMANCE, AND CREDIBILITY
PRODUCED BY TOXIC AGENT TRAINING AT THE
CHEMICAL DECONTAMINATION TRAINING FACILITY

Final Report for the
U.S. Army Chemical School

by

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SUMMARY

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This evaluation measured the stress associated with a training exercise involving chemical warfare agents and tested whether the exercise changed the confidence, credibility or performance of those taking it. The on-site evaluation included over 100 subjects for all tests and over 1000 for some. An additional part of the study addressing credibility was conducted away from the training site during the same approximate time and involved 240 non-Chemical Corps subjects. Biomedical, questionnaire, and behavioral measures of stress were not in strong agreement, but on the whole supported the conclusion that the training exercise was mildly stressful. Questionnaire measures of confidence related to working on a chemically contaminated battlefield were clearly higher for subjects trained with toxic agent than for subjects without such training. Combat Arms Officers and NCOs were strongly in favor of such training for their own units as well as the Chemical Corps, suggesting that the exercise will enhance the credibility of graduates. (SDW)

INTRODUCTION

This report describes an evaluation of certain aspects of the new Chemical Decontamination Training Facility (CDTF) at the USA Chemical School, Ft. McClellan, Alabama. The CDTF includes a specially designed indoor environment where military vehicles are contaminated with small amounts of potentially toxic agents. Trainees perform detection and decontamination exercises on these vehicles while wearing a standard issue (MOPP IV) protective ensemble. The questions to be answered concern the value of the toxic agent exercise and the stress and perceptions associated with it. This evaluation was carried out in response to a request by the Undersecretary of the Army, through the Army's Training and Doctrine Command (TRADOC), to the Office of the Surgeon General (OTSG).

The School provides instruction to Chemical Corps personnel ranging from junior enlisted through mid-career officers. In a series of courses including both classroom and practical exercises, students learn to detect chemical warfare agents, decontaminate personnel and equipment, recognize and treat symptoms of toxic agent poisoning, assess chemical battlefield scenarios and do a variety of other related tasks. In the belief that realism enhances training effectiveness, each course ends with an exercise using actual toxic agents in the CDTF. Beginning in mid-March 1987, the chemical instruction block of each course has ended with the CDTF program.

The CDTF exercise, as originally implemented, occupied two successive mornings, each starting with a detailed safety briefing. On the first day, students rehearse agent detection and vehicle decontamination in MOPP IV in the open air; no agent is used. On the second day, students work inside and encounter several military vehicles contaminated with approximately 5-9 cc of either concentrated VX or GB. They attempt to identify the agent on each vehicle and perform the appropriate decontamination routine. Students know in advance neither the identity nor the amount of agents. VX is non-volatile and a threat by skin contact. GB is volatile and a threat through inhalation, eye or skin contact. Five to nine cc of either agent would be quickly lethal if fully taken into the body and will activate the agent detectors with which the students are trained. The vapor hazard from five cc of GB in the exposure facility is estimated to produce mild eye symptoms after about two hours in an unprotected individual.

Planning for the CDTF included extensive discussions among the Chemical School and the Army Medical Department including the Health Service Command's Environmental Hygiene Agency and the Consultant to the Surgeon General for Preventive Medicine. Discussions concerned the kinds and amounts of agents to be used and the safeguards needed to protect both students and CDTF staff. These efforts determined the guidelines for a specially designed building with sophisticated ventilatory and other decontamination equipment, sensitive chemical agent monitoring devices, amount of agent in use at any time, procedures for entering and leaving rooms containing toxic agent, medical testing of trainees and staff, screening of trainees and other precautions.

GENERAL OBJECTIVES

Our objectives addressed two broad concerns generated by the use of toxic agent and by the facility's safety measures:

A. Are Chemical School programs substantially more stressful for including training with actual agent? This concern was prompted by the main argument offered in support of the CDTF that realistically demanding exercises will better prepare students to perform well in combat. But what if students don't take the facility and exercise

seriously? The amount of agent is small and the precautions numerous and obvious; perhaps it is all so safe as to not be particularly stressful. We examined this concern with a multi-dimensional assessment of stress associated with the CDTF exercise and the trainees' perception of it. The measures employed were sufficiently sensitive to allow detection of incremental changes in stress relative to the School's pre-CDTF programs and sufficiently established to allow comparison with other obviously stressful situations such as parachute jumping.

B. Regardless of how stressful the CDTF experience may be, are there changes in other measures more directly related to trainees' future success? This concern arose because the final goal of training is not to create stress per se, but to enhance the student's confidence that his training, equipment and doctrine will be an effective counter to the use of chemical agent weapons by some future enemy. An additional goal is to enhance the credibility of the graduates in the eyes of those they serve with and under after they leave the school. Implicit in these goals is the assumption that increased confidence and credibility will mean enhanced battlefield performance. We thus measured three additional parameters to which realistic training may be related: confidence, credibility and performance.

Stress is generally related to performance through an inverted U function: some stress is valuable, a bit more may be better, too much is detrimental. The means for studying confidence, credibility and performance are situation specific so that we were able to detect incremental changes between the new and current Chemical School programs, but we were unable to make simple comparisons with other environments outside the School or to place incremental changes on an absolute scale.

HYPOTHESES

A. Ft. McClellan courses including the CDTF will be more stressful than courses not employing toxic agent.

B. Soldiers trained in the CDTF will be more confident than those not so trained.

C. Soldiers trained in the CDTF will be more credible outside the Chemical Corps than those not so trained.

D. Soldiers trained in the CDTF will perform better than those not so trained.

STUDY PLAN

Special features and constraints

Several aspects of the situation under study particularly influenced the design of the evaluation.

1. The CDTF could begin operation only once. After toxic agent was first made and used there, the School could not advertise the facility as "clean". Crossover designs were thus excluded. Thus, the outcome may thus have been influenced by uncontrolled factors differentially affecting subjects in the two phases of the study (e.g. seasons of the year, recruiting standards and other variables that may have changed over time).

2. Trainees were told about the toxic agent exercise at the start of each Chemical School course. Knowing about the upcoming trip to the CDTF may have influenced the

students to pay better attention to course material and may be an important means of accomplishing this desired end. We could not blind the trainees, the trainers or the experimenters on the identity of reference and experimental subjects. Outcomes may have been influenced by the expectations of those involved.

3. We cannot state a precise start time or duration for "the event" being studied at either the individual or organizational level. Students may have anticipatory reactions before actually entering the contaminated rooms. As discussed below, we managed this issue by collecting some data before the subjects take the exercise itself. In addition, Ft. McClellan almost certainly experienced a collective "novelty" response associated with starting CDTF operations. Publicity, visitors, new procedures, personnel re-assignments, etc., all had effects. Because students go through the CDTF at a high rate (over 100/week) and because of our experience evaluating introduction of the Army's COHORT system, we think the novelty effect should have worn off in a month or two. We thus started much data collection well before first use of the CDTF and continued for several months afterwards

4. Studying the CDTF involved choosing a suitable reference to address the question of "how stressful compared to what?". Had the School simply added toxic agent to the ongoing exercises, without other significant changes, we could easily have studied those exercises before agent was introduced for reference. However, the CDTF "package" was an entirely new part of the curriculum which, besides toxic agent exercises, includes a forbidding new building, special medical screenings for students, safety briefings and elaborate emergency procedures. Thus, there was no simple baseline for comparison. We managed this issue in two ways. First, the biomedical stress measures employed have been studied in other, undeniably stressful situations such as parachute jumping, cardiovascular "stress" testing and appearance before a military awards board. We thus drew general comparisons between the CDTF experience and stressful situations outside the School. Second, the School conducted, at our request for the purpose of this evaluation, a CDTF "dry" run when the facility first became available. The "dry" run involved all CDTF facilities and procedures but no toxic agent. Participants knew that no agent was involved. This reference period, although artificial was unavoidable for isolating the specific question prompting this study: does toxic agent itself make a significant difference in training.

5. Because the School teaches many courses to a variety of students and some kinds of trainees pass through in much larger numbers than others, there was no single "program" to be evaluated, although the CDTF exercise itself is identical for everybody. We managed this issue by focusing attention on a distinction we and the School staff think may be critical: prior Army/Chemical Corps experience vs. no previous experience. Subjects were drawn only from Officer Basic, Officer Advanced, ANOC and AIT classes.

6. We cannot state for all hypotheses and tests the smallest size change to be declared meaningful. For example, we can argue confidently that a heart rate increase from a resting value of 65 to 75-80 beats per minute (about 1 standard deviation) is the least change consistent with "stress", but we can make no similar statement about confidence. If a 20% increase in confidence is important, should a 4% increase be judged trivial? We thus faced difficulty in choosing appropriate sample sizes for many individual tests. We attempted to manage this issue by erring on the side of too much data rather than too little for most measures.

7. The kinds of data needed to address all hypotheses could easily have generated a study which overwhelmed the School's ability to conduct business normally and distorted the phenomena we hoped to assess. We managed this issue by restricting some intrusive

data collection procedures to limited periods of time and modest samples of subjects. The data involved, fortunately, were those for which we had the clearest idea of minimal useful sample size.

8. We were severely limited in attempting to collect data, other than by simple observation, inside the CDTF during the toxic agent exercise itself. This was partly because decontamination regulations restricted our ability to make measurements (e.g. draw blood samples) and move measurement tools (clip-boards, blood pressure monitors, etc.) in and out of the training rooms. It was also because the number of students in each CDTF group (10-20), and the collective nature of the identification/decontamination exercise, precluded any easy assessment of individual task performance ability. We thus collected most data immediately before and after the actual exercise.

Study design. Because a major goal of the CDTF is to reduce the stress of a future chemical battlefield by showing soldiers they can survive and function in the presence of chemical warfare agents, we were interested in studying whether a successful decontamination exercise was associated with decreased stress on a subsequent exercise. To facilitate this, the Chemical School agreed to extend CDTF exercise to 3 days for the eight classes from which we collected our biomedical measures of stress.

Hypotheses A,B & D (stress, confidence and performance) were evaluated at the Chemical School through a one-time, unblinded comparison of measures taken before and after introduction of toxic agents to the CDTF. Major features of this procedure were a simple before-after contrast ("dry" run vs. "wet" run) with no crossovers. Data collection for performance measures and confidence started six months before the CDTF opened and continued for three months afterward. Hypothesis C (credibility) was studied away from the Chemical School with a short questionnaire at combat arms posts in the U.S. and Germany. The study plan will be elaborated by describing the dependent variables, subject selection, sample size, data collection, and data analysis.

Dependent variables. Stress was assessed through biomedical and psychological measures generally associated with "stress" responses. Biomedical measures included heart rate, blood pressure, blood hormones (cortisol, prolactin, ACTH and beta-endorphin) and overnight urinary hormones (cortisol and adrenalin). Heart rate, blood pressure and blood hormones are relatively acute indices of stress with rapid response times. Overnight urine collection (all urine from midnight until arrival at the CDTF at 0730) for stress hormones provides an integrative index reflecting a longer time period. These measures have well established population values and have been studied previously in clearly stressful situations - such as parachute jumping and appearance before military boards (1-4). With the exception of heart rate, these measures were collected before and after the CDTF exercise (see Fig. 1). Subjects were asked to refrain from heavy exercise on the test days to avoid contamination from intense exercise. Heart rate was collected with a 4-lead battery powered portable recording system (Medilog) worn under the uniform by a subset of subjects from 0630 until the conclusion of the CDTF exercise each day. Actual heart rate data used in the analyses was limited to minute by minute rates for the first 10 minutes in the "hot" section of the facility during protective mask testing and the first 10 minutes following application of toxic agent to the vehicle to be decontaminated. Physical activity during both of these periods is limited and relatively standardized.

Psychological stress measures included: a mood adjective checklist which can be analyzed to provide indices of fear, anger, depression, fatigue, activity and happiness. This checklist has previously proved sensitive in military exercises involving the chemical protective suit (Appendix 3, ref. 5). Group interviews of students and instructors

participating in the exercise, student estimates of the risk entailed by the CDTF exercise and direct observation of students during the exercise were also included. Interviews allowed us to pick up information not available through the standard tests. The risk scales, unlike the mood scales, provided the subjects a chance to report their perceptions of potential or experienced stress without labeling themselves or their own feelings..

Confidence was evaluated with a questionnaire written especially for this study (Appendix 1). It consisted of ten questions, to be answered on a seven point Likert scale, addressing the soldier's confidence in his ability and that of his classmates to survive a chemical attack, identify agent, decontaminate equipment, provide first-aid, and instruct others on how to do these things. It was given once, as part of the end-of-course critique following completion of the CDTF exercise. Pre-tests at the School showed responses to be distributed in two senses: first, they were not so extreme as to preclude improvement/decrement; second, they showed confidence to be greatest on those tasks most heavily emphasized in the instruction.

Credibility was evaluated with a specially designed questionnaire (Appendix 2) given to NCO's and officers in combat arms assignments. Four questions assessed the extent to which respondents believed toxic agent training would have positive effects on their unit. One question asked the subjects how much he would pay, in unit training time, to get such training for his own soldiers. This questionnaire also underwent considerable pretesting and revision to insure face validity with both subjects and Chemical School staff and a response distribution which would allow detection of a small improvement (or decrement) in credibility.

Performance was evaluated by examining the scores of written competence tests given by the School as part of its regular instruction process. Because all instruction and testing is done before the CDTF drill, consistent changes in test scores might be attributable to an anticipatory effect associated with the facility. Although written School tests are certainly an imperfect and limited index of battlefield performance capacity, safety regulations and the collective nature of the decontamination exercise precluded any measure of hands-on performance in the CDTF itself.

Subject selection. The Chemical School staff suggested evaluating officers and enlisted, experienced and naive subjects. They offered the opinion that the most important distinction may fall between experienced and inexperienced, that is, between officers and enlisted soldiers new to the Army and Chemical Corps and those with several years' previous Chemical Corps experience. We accordingly drew subjects from four School courses: Officer Basic (OB), Officer Advanced (OA), Junior Enlisted (B10), and Advanced Non-Commissioned Officer (ANOC).

Sample size. Performance and confidence measures were collected from all students at the school for six months preceeding and for three months following introduction of toxic agent into the CDTF. All other measures were collected from volunteers solicited several days prior to the CDTF exercise, after a thirty minute group briefing on the nature of the study. Students were encouraged to volunteer to provide all dependent measures but were allowed to participate in any subset of their choosing. Classes for the four courses included 20-40 students each. Volunteer rates were generally lowest for providing blood samples (12-20 from a class of 20-40). Mood questionnaires and blood pressure measurements were offered by nearly all students (>90%). Overnight urine samples were provided by >80% in every class. More than 50% of each class volunteered to wear cardiac monitors. As we had only fifteen monitors available, volunteers were selected for cardiac monitoring first from those who had volunteered for all dependent variables. If more than fifteen individuals volunteered for all variables, we simply chose

fifteen subjects at random. Volunteers received no rewards for participating and non-volunteers were in no way discriminated against. These conditions were made known before soliciting participation.

The sample for the credibility questionnaire consisted of 190 NCOs and 48 company grade officers from combat arms units at two bases in the U.S. and two in Germany. No attempt was made to collect a sample representative of the entire Army. The bases sampled were, by and large, those at which we are conducting other studies. Branches included in significant numbers were infantry, armor, engineers, aviation.

Statistical Analysis

The biomedical data was subjected to repeated measures analyses of variance (ANOVA) using the General Linear Model (GLM) procedure of SAS Institutes Statistical analysis System. A conservative significance level of 0.01 was chosen because of the large number of dependent variables (and tests) involved.

RESULTS

Stress

Urinary hormones. Table 2 displays the data on overnight urinary output of the "stress" hormones, cortisol, adrenalin, and noradrenalin, grouped according to type of course (basic, i.e., AIT and Officer Basic; and advanced, i.e., Officer Advanced and Advanced NCO). As summarized on the bottom row of Table 2, cortisol output did not vary over the three days of the exercise in either the "dry" control exercises or the "wet" toxic agent training exercises and was not different between dry or wet runs in either basic or advanced students. Adrenalin output, on the other hand, was statistically increased during the toxic agent training exercises compared to the control period (Figure 1). The significant agent by experience interaction reflects the fact that the difference in dry run and wet run adrenalin output was almost entirely confined to the basic course groups (Figure 2). Adrenalin output was higher on each of the three nights before the wet run exercises compared to the dry runs, even though the first day of the wet run employed simulated agent and was run out of doors. Noradrenalin output was associated with a significant agent by experience interaction. This was the product of noradrenalin output being higher for the basic course and being lower for the advanced course during the wet runs as compared to the dry runs. Overall, these findings support the hypothesis that working with actual toxic agents during exercises at the CDTF would be more stressful than similar exercises during the control period and suggest that even anticipation of training with actual toxic agents is stressful.

Blood hormones. Blood samples collected just prior and just subsequent to the training exercises were designed to look at instantaneous stress hormone levels, at times closer to the exercise itself than the overnight urine collection allowed. The best test of the hypothesis that toxic agent training was stressful would have been samples taken during the exercise itself but this procedure was precluded by subject safety considerations. Table 3 displays the data for plasma cortisol and several other stress hormones including adrenocorticotrophic hormone (ACTH), beta-endorphin and prolactin. These four hormones did not vary over the three morning (before) samples for the exercises in either the dry or the wet runs. None of the hormones appeared to be affected by the "threat" or "fear" of toxic agent training in either the basic or advanced classes. Values of cortisol and ACTH were lower after the exercise on Day 2 than prior to training on any of the three days, producing a significant time effect in the analysis for these hormones. Although this decrease might be attributed to a decrease in stress upon completion of a hazardous job, it is also the case that cortisol and presumably

ACTH show a pronounced diurnal rhythm, a rhythm which is associated with steadily decreasing values throughout the day. The time x agent interactions reflects the finding that wet exercises were associated with a smaller decrease over the same time period than the dry exercises. We can speculate that this means that the wet runs were more stressful than the dry runs.

Blood pressures. Blood pressure, like blood hormones, were also sampled just prior to and subsequent to each 2-4 hr training session. Table 4 shows our findings. Although all values for both systolic and diastolic pressure are tightly clustered, ANOVA revealed significantly higher systolic and diastolic blood pressures for the advanced classes. This can be most parsimoniously explained by their higher age. There were significant agent and time effects for diastolic blood pressure as well. The time effect reflects a very small (3mm) but consistent decrease over the four measurements, which is consistent with a decreasing level of stress. The finding that diastolic blood pressures were higher in the dry runs, however is the reverse of that predicted by hypothesis A. The only legitimate conclusion from these data is that there is probably some stress involved in the CDTF, but that blood pressure measures provide no evidence for the hypothesis that it is primarily due to the toxic agent training.

Heart rate. A similar conclusion can be drawn from data on heart rate (Table 5). Pulse rates were taken in conjunction with the blood pressure measurements prior to entering the CDTF training building. Additionally, heart rate was recorded in a sample of fifteen subjects throughout the exercise proper. The center and right columns of the tables show selected data collected during the time in the mask check room and for ten minutes upon first entering the training bays. These time periods were selected not only because stress was presumed to be highest during the mask check and upon initial entry into the training bays. Subjects were, by and large, standing quietly listening to instructions so that changes in heart rate can reasonably be attributed to anxiety rather than physical work. Both the heart rate from the highest single minute from the first ten min in the mask check room or the training bays or the mean heart for these periods were markedly elevated over classroom values. Statistical analysis provided no justification for attributing this increase in heart rate to toxic agent training, since the elevated rate was just as prominent in the dry run as the wet run. This finding suggests that wearing MOPP gear, going through the mask check, or some perception associated with the entering the training facility provoked autonomic arousal. In general, pulse rates were inexplicably lower for the wet runs compared to the dry runs. Overall, these findings for heart rate suggest that training at the CDTF is stressful but they do not provide support for hypothesis A, that training with toxic agents will be more stressful compared to training with simulants.

Taken as a whole, the biomedical measures of stress (hormones, blood pressure, heart rate) provide only modest support for hypothesis A, that courses including toxic agent training in the CDTF are more stressful than courses not employing toxic agent. The data provide somewhat more support for concluding that training in the CDTF, with or without agent, is a significant stressor.

Questionnaires. The biomedical measures of stress were supplemented by questionnaire measures administered immediately prior to and subsequent to each day's training exercise. Subjects were instructed to answer the second questionnaire each day by describing their mood during their initial moments in the exercise itself. Table 6 summarizes the data of interest from the mood checklist. The "fear" columns show the mean scores on six near-synonyms of fearful, where zero means "not applicable to me at the moment" and six means "very much true of me at the moment". The "fatigue" columns also shows mean scores for six near-synonyms of tired. The right half of the

table shows the highest scores on twelve adjectives generally associated with "positive" mood (e.g. happy, lively, satisfied) and twenty-five adjectives indicating "negative" mood (e.g. downcast, angry, uneasy, miserable). The data in the table were analyzed with a repeated measures ANOVA and the bottom row of the table summarizes the findings. Fear scores were very low overall, especially for the ANOC and OA subjects. Fear scores for the basic group appeared to be nearly as high in the dry run as the wet run with the exception of just prior to entering the training bay (pre-day 2, Figure 3). This was not the case for advanced subjects who appeared to have higher scores throughout the wet run compared to the dry run. Both the basic and advanced groups had a significant falloff in fear scores after day 2. Fatigue scores were notable only in reliably declining over the three days, as did positive mood scores. The wet groups, regardless of course type, generally scored higher on positive adjectives.

Table 7 shows the mean subjective risk associated with the CDTF exercise, parachute jumping and the ratio of assessed risk of CDTF exercises and parachute jumping. A zero score represents "a completely no-risk activity" and a score of ten "the most risky or dangerous activity a person could possibly do". Students in the wet runs did not differ from subjects in the dry runs in their assessment of the risk of parachuting. These ratings stayed steady at about 6.0 throughout the three days. Students in the wet runs assigned the CDTF exercises a rating of about 4.5 on this scale prior to training, while subjects before the dry runs rated the CDTF at about 2.5. After three days of training at the facility, these ratings dropped to about 2.5 and 1.6, respectively. Students in both dry and wet runs saw the CDTF training as considerably less dangerous after the training (Figure 4). There was no evidence of differences in any ratings between the basic and advanced groups.

Direct observation. Analysis of observer notes on student-initiated departures from the training exercise revealed a striking difference between the dry run classes and their counterparts working with toxic agents. Table 8 shows the incidence of these departures and the reasons provided by the students. Our observers' notes were supplemented by analysis of CDTF records which routinely recorded such incidents. The data in the table includes all classes going through the CDTF between January and May 1987. Students came out of the exercise more than six times more frequently when toxic agent was employed, strongly suggesting that training with toxic agent is more stressful than CDTF training with simulants. It should be noted that none of these students showed any clinical indication of exposure to agent or a drop in red blood cell cholinesterase which would follow such exposure. Most of the students returned to the exercise within minutes, though in a number of instances these minutes included a reminder that graduation was contingent upon successful completion of CDTF training.

In summary, the biomedical, subjective, and behavioral measures of stress described above provide modest support for hypothesis A, that CDTF training with toxic agents is more stressful than such training not employing toxic agent. The single most well-accepted hormonal measures of stress, adrenalin, was significantly higher in the classes using toxic agents, especially the junior enlisted and officer basic classes. Although few soldiers admitted to feeling much fear about the exercise, the junior enlisted and officer basic students in the wet runs initially rated the training nearly as dangerous as parachuting. Soldiers found reasons to leave the training exercise six times more frequently when toxic agents were involved than when detection and decontamination involved simulants.

Confidence. Comparisons of control and agent classes on each of the ten questions of the confidence questionnaire are shown in Table 9 and Figure 5. Scoring was reversed on question #3 for ease of display and analysis. This question, which asks students how many

of their classmates will panic the first time they face a major chemical attack, would be given a low rating by confident soldiers, unlike the remainder of the questions, where confidence would be indicated by high scores. The data in the table were again analyzed with a repeated measures ANOVA, with agent (wet, dry) and experience (basic, advanced) as between-subjects variables. Training with toxic agents had a highly significant effect. In fact, subjects in the wet runs scored significantly higher than controls on every one of the ten questions. Experience was also a significant factor. Basic course students generally expressed more confidence than advanced course students with statistically significant differences on questions 2,5,8,9, and 10. The significant F-ratios for Questions and Interactions of agent and course type with Question merely confirms that the ten questions were not completely redundant - i.e. scores of all four groups varied across questions. Hypothesis B, that soldiers trained in the CDTF with toxic agent will be more confident than those not so trained, seems solidly confirmed by these data. This was true for both basic and advanced courses.

Credibility The seven-item credibility questionnaire (Appendix 2) was analyzed in three parts: questions 1-4, which generally ask the respondent to indicate the extent to which he believes the use of toxic agent in the training of Chemical Corps NCO's and officers will have a positive effect on his unit and ones like it; question 5, which asks the respondent how much he would pay, in training time, to obtain live agent training for his soldiers; and questions 6-7, which assess the respondent's view of his unit's current readiness to fight on a chemical battlefield. The last two questions were included not so much as credibility measures, but as an aid in interpreting the data from questions 1-5. It would be reasonable to expect that officers or NCO's who were currently very confident in their units' ability to perform despite attack by chemical weapons would be unwilling to spend additional training time for toxic-agent training for their soldiers. For security reasons, we do not report the mean scores on these two questions, but there were no significant correlations between scores on these questions and scores on questions 1-5. Judgments about the desirability of toxic agent training were made independently of judgments about the readiness of one's own unit.

Table 10 shows the mean scores on each of the first five questions. Analysis of variance showed no significant effects of rank (NCO vs Officer), location (4 bases), or specialty (11 different fields), so the scores shown include all respondents. Mean scores are uniformly high and the modal score (i.e. the single most commonly chosen answer) was 6 for every question, expressing maximum approval of toxic agent training. For each of the 5 questions, over 30% of the respondents gave this answer. Figures 5 and 6 show the breakdown of responses by per-cent to Question 1-4 and Question 5, respectively,

Performance Scores on the final exam for the chemical block of all four student course groups contributing subjects to this study were the sole measure of performance employed. Even though in most cases this exam took place prior to the CDTF training exercise, it was hypothesized that anticipation of toxic agent training would have a positive effect on student motivation, which would be reflected in higher grades on the final exam. As Table 11 reveals, the data failed to support this hypothesis. Exam scores in general were quite high, averaging about 90%. This suggests that students were highly motivated, with or without toxic agent training in their future. The small but statistically significant difference between the test scores for the basic and advanced course students suggests that there was perhaps still room for improvement with the introduction of toxic agent training. Confining the analysis to those who scored less than 70, or less than 80, or less than 90, did not alter the conclusion that the prospect of toxic agent training had no effect on final exam scores. For example, just as many students scored below 70 in the agent classes as in the control classes.

DISCUSSION

To study the impact of training with toxic agents at the new Chemical Decontamination Training Facility, we addressed two broad concerns: 1) Are Chemical School programs substantially more stressful for including training with actual agent? and 2) Regardless of how stressful the CDTF experience may be, are there changes in other measures more directly related to trainees' future success?. The four hypotheses to be tested necessitated a comprehensive battery of objective and subjective measures to permit generalizations from the findings. We envisioned three possible outcomes: 1) changes in the direction of "more" stress, confidence, credibility and improved performance; 2) changes in the direction of "less" stress, confidence, credibility and decreased performance; and 3) no change. More stress was presumed to be desirable, within limits described below. Less stress would be viewed as undesirable, as the goal of the program is to provide more stressful and therefore more realistic training. No change is generally not interpretable, as it could mean either no effect, an inappropriate measurement or a poorly done measurement. This is a particular concern because we were studying a new environment with few "textbook" values. Thus, in thinking about the overall outcome, we tend to ignore the "no difference" outcomes and contrast the "more" with the "less" outcomes.

To study these issues, we employed an open comparison of training in the new facility with simulants or toxic agents. Classes from each of the four major student groups, namely AIT, ANOC, OB and OA, voluntarily participated in the two phases of the study. Approximately 125 soldiers volunteered in both the dry runs and wet runs which represented over 90% of those going through the training during the study periods. Nearly all volunteers filled out questionnaires and collected three consecutive overnight urine samples. Approximately half had repeated venipuncture for blood collection. Additionally, nearly 1000 performance measures and confidence questionnaires were collected for six months before the CDTF opened and for three months afterward. The credibility questionnaire was administered to 240 Combat Arms Officers and NCO's at combat arms posts in the U.S. and Germany.

Biomedical, questionnaire and behavioral measures of stress were not in strong agreement, but provided modest support for hypothesis A, that CDTF training with toxic agent is more stressful than similar training not employing agent. The single most well-accepted hormonal measure of stress, urinary adrenalin, was significantly higher in the the junior enlisted and officer basic classes during the "wet runs" after toxic agents were added to the training than in the "dry runs". Adrenalin output was higher on each of the three nights before the wet run exercises, even though the first day of the wet run employed simulated agent and was run out of doors. This suggests that mere anticipation of training at the CDTF with toxic agents is stressful and that the stress of toxic agent training is not limited to the exercises in the training bays. Although few soldiers admitted to feeling much fear about the exercise, junior enlisted and officer basic students anticipated that the CDTF exercise with toxic agents would be nearly as dangerous as parachuting. This perception declined after actual participation in the training. Soldiers found reasons to leave the training bays six times more frequently when toxic agent was involved than when detection and decontamination were simulated.

The failure to detect changes in plasma hormones may reflect the immediate and short-term nature of the actual exercise in the training bays when we were unable to collect samples due to safety reason. Conversely, the major stressor may not have been sufficient to stimulate increased secretion of the hormones measured. This would appear to be the case as cortisol has a delayed response and a sufficiently long half-life in plasma to be useful as a marker of stress in the period following the actual incident.

Thus, while the anticipation and perception of the danger of toxic agent were sufficient to cause arousal and avoidance responses in the subjects, the stress was clearly not of the magnitude associated with parachute jumping. This is not surprising as biomedical responses are most likely to be large when an individual perceives something as "instinctively" threatening or dangerous, such as being attacked by a large animal, falling from a height, being trapped in a fire, etc. Biomedical responses are less likely to be robust when facing something known to be dangerous only because someone told you so and, as in this case, when extensive safeguards are provided.

How stressful, then, was the toxic agent training exercise? It was clearly not so unremarkable that it failed to impress anything useful on those going through it, but it was not so threatening or terrifying as to overwhelm the students and prevent them from learning from the experience. That is, the exercise is stressful enough to capture the student's attention, but not so stressful as to destroy training value. This appeared to be less true for the experienced soldiers and suggests that the program may need to be tailored to challenge the experienced soldiers.

Hypothesis B, that soldiers trained in the CDTF with toxic agent will be more confident of working on a chemically contaminated battlefield than those not so trained seems solidly confirmed by the consistently higher scores on the confidence questionnaires for subjects trained with toxic agent than for subjects without such training. It should be noted that the confidence levels of the students was quite high to begin with and suggests that the core curriculum is providing thorough training in the basics of chemical decontamination.

Assessing credibility generated by the CDTF among those outside the Chemical Corps was probably the most difficult hypothesis to test as it could only be approached indirectly. We couldn't follow the graduates of the CDTF for several years out in the field and compare them to those without such training. We had to settle on hypothetical questions which were poorly able to describe the CDTF environment in detail for those answering the questions. However, the enthusiasm for training with toxic agent shown by the Combat Arms Officers and NCOs who took the credibility questionnaire solidly confirmed Hypothesis C, that soldiers trained in the CDTF will be more credible outside the Chemical Corps than those not trained. Combat arms officers and NCO's were, in fact, strongly in favor of toxic agent training for their own units, as well as for the Chemical Corps.

Although a positive relationship with final exam scores would have further increased our own confidence in the ability of toxic agent training to enhance battlefield performance, final exam scores failed to provide any support for hypothesis D, that soldiers trained with toxic agent will perform better than those not so trained. Class scores were quite high in both situations and there would have had to be a huge impact to see such an effect. Failure to improve final exam scores should certainly not be taken as evidence that battlefield performance will be unchanged by toxic agent training.

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TABLE 1: Data Collection Plan.

| <u>GROUP:</u> | <u>BACKGROUND A</u> | <u>DRY RUN</u> | <u>BACKGROUND B</u> | <u>WET RUN</u> |
|-----------------------|--------------------------------|-------------------------------|---------------------------------|--------------------------------------|
| <u>COMPOSITION:</u> | 390 E10; 60 ea OB, ANOC; 40 OA | 25 ea. E10, OB, ANOC, OA | 300 E10; 60 ea. OB, ANOC; 40 OA | 25 ea. B10, OB, ANOC, OA |
| <u>START:</u> | 12 weeks before CDTF opens | At CDTF opening | Immediately after Dry Run group | Immediately after Background B group |
| <u>DURATION:</u> | 12 weeks | 5 weeks | 12 weeks | 5 weeks |
| <u>TOXIC AGENT:</u> | Absent | Absent | Present | Present |
| <u>BIOMEDICAL:</u> | Not collected | All subjects, see in Figure 1 | Not collected | All subjects, see Figure 1 |
| <u>MOOD:</u> | Not collected | All subjects, see Figure 1 | Not collected | All subjects, see Figure 1 |
| <u>RISK ESTIMATE:</u> | Not collected | All subjects, see Figure 1 | Not collected | All subjects, see Figure 1 |
| <u>INTERVIEWS:</u> | 4 classes | 4 classes | 4 classes | 4 classes |
| <u>CONFIDENCE:</u> | All subjects | All subjects | All subjects | All subjects |
| <u>PERFORMANCE:</u> | All subjects | All subjects | All subjects | All subjects |

TABLE 2: Mean Urinary Concentrations (Mcg/8hrs) of Stress Hormones in Subjects Trained with Simulants (Dry Run; N=124) and Toxic Agents (Wet Run; N=101), Grouped by Type of Course (Basic or Advanced).

| | <u>HORMONE</u> | | | | | |
|----------------|----------------|------|--------------------|-----|--------------------|-----|
| | Cortisol | | Adrenalin | | Noradrenalin | |
| | Dry | Wet | Dry | Wet | Dry | Wet |
| Day 1 | | | | | | |
| Basic | 15.6 | 19.1 | 1.7 | 3.6 | 6.7 | 7.9 |
| Advanced | 15.7 | 16.1 | 2.9 | 3.0 | 9.2 | 6.7 |
| Day 2 | | | | | | |
| Basic | 18.8 | 14.7 | 1.9 | 3.1 | 7.3 | 7.0 |
| Advanced | 16.1 | 14.6 | 2.7 | 2.8 | 9.3 | 6.6 |
| Day 3 | | | | | | |
| Basic | 17.7 | 15.8 | 1.7 | 3.1 | 5.7 | 7.0 |
| Advanced | 13.6 | 16.7 | 2.6 | 2.7 | 8.6 | 6.1 |
| Significant F | --- | | agent | | --- | |
| ($p < 0.01$) | --- | | agent x experience | | agent x experience | |

TABLE 3: Mean Blood Plasma Concentrations of Stress Hormones in Subjects Trained with Simulants (Dry Run; N=120) and Toxic Agents (Wet Run; N=76), Grouped by Type of Course (Basic or Advanced).

| | <u>HORMONE</u> | | | | | | | |
|-------------------------------|----------------------|--------------|-----------------|--------------|---------------------------|--------------|----------------------|--------------|
| | Cortisol (mcg/dl) | | ACTH (pg/ml) | | Beta-Endorphin (pg/ml) | | Prolactin (ng/ml) | |
| | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet |
| Day 1 (before) | | | | | | | | |
| Basic | 11.3 | 10.1 | 12.9 | 12.4 | 10.9 | 12.4 | 4.5 | 4.3 |
| Advanced | 13.2 | 11.1 | 16.8 | 11.0 | 11.8 | 11.7 | 4.9 | 3.5 |
| Day 2 (before) | | | | | | | | |
| Basic | 11.4 | 10.6 | 13.3 | 12.4 | 12.5 | 11.3 | 4.8 | 4.6 |
| Advanced | 11.9 | 11.5 | 16.4 | 10.2 | 12.1 | 12.2 | 4.9 | 4.3 |
| Day 2 (after) | | | | | | | | |
| Basic | 8.0 | 8.4 | 12.2 | 12.9 | 11.3 | 11.5 | 4.7 | 4.8 |
| Advanced | 8.2 | 9.6 | 12.1 | 13.8 | 10.6 | 11.5 | 5.1 | 4.5 |
| Day 3 (before) | | | | | | | | |
| Basic | 10.6 | 9.8 | 11.7 | 10.6 | 10.8 | 11.5 | 5.1 | 5.0 |
| Advanced | 11.2 | 10.6 | 13.9 | 9.7 | 10.6 | 11.9 | 5.3 | 4.4 |
| Significant F (p < 0.01) | time | time | time | time | time | time | time | time |
| | time x agent | time x agent | time x agent | time x agent | time x agent | time x agent | time x agent | time x agent |

TABLE 4: Mean Blood Pressures (Mm Hg) of Subjects Trained with Simulants (Dry Run) and Toxic Agent (Wet Run), Immediately Prior or Subsequent to CDTF Training, Grouped by Type of Course (Basic or Advanced).

| | Systolic | | Diastolic | |
|---------------------------------|----------|------------|-----------|------------|
| | Dry | Wet | Dry | Wet |
| Day 1 (before) | | | | |
| Basic | 126 | 127 | 73 | 71 |
| Advanced | 128 | 129 | 83 | 79 |
| Day 1 (after) | | | | |
| Basic | 122 | 123 | 73 | 72 |
| Advanced | 126 | 129 | 83 | 80 |
| Day 2 (before) | | | | |
| Basic | 124 | 125 | 74 | 71 |
| Advanced | 126 | 128 | 80 | 78 |
| Day 2 (after) | | | | |
| Basic | 124 | 123 | 73 | 70 |
| Advanced | 128 | 128 | 82 | 78 |
| Day 3 (before) | | | | |
| Basic | 123 | 120 | 72 | 69 |
| Advanced | 127 | 126 | 82 | 76 |
| Day 3 (after) | | | | |
| Basic | 124 | 121 | 72 | 68 |
| Advanced | 126 | 124 | 78 | 75 |
| Significant F ($p < 0.01$) | --- | experience | agent | experience |
| | | --- | | time |

TABLE 5: Mean Heart Rates (bpm) of Subjects Trained with Simulants (Dry Run) and Toxic Agent (Wet Run), During Selected Periods of CDTF Training, Grouped by Type of Course (Basic or Advanced).

| | One Minute Seated in Classroom Just Prior to March to Training Building | | Highest Single Minute While in Mask Check Room or First 10' in | | Mean of First 10' in Mask Check and First 10' in Training Bay | |
|---------------------------------|--|-----|---|-----|--|-----|
| | Dry | Wet | Dry | Wet | Dry | Wet |
| <u>Day 2</u> | | | | | | |
| Advanced | 67 | 63 | 94 | 96 | 84 | 84 |
| Basic | 67 | 66 | 99 | 94 | 88 | 82 |
| <u>Day 3</u> | | | | | | |
| Advanced | 69 | 62 | 101 | 95 | 39 | 83 |
| Basic | 70 | 68 | 95 | 93 | 85 | 82 |
| Significant F ($p < 0.01$) | --- | --- | Agent | | --- | |

TABLE 6: Average Scale Scores for Selected Elements of the Mood Adjective Checklist for Subjects Trained with Simulants (Dry Run) and Toxic Agent (Wet Run) Immediately Prior to and Immediately After Entering the CDTF, Grouped by Type of Course (Basic or Advanced).

| | Fear | | Fatigue | | Positive | | Negative | |
|------------------------|------------|--------------|------------|------|------------|------|------------|------|
| | Dry | Wet | Dry | Wet | Dry | Wet | Dry | Wet |
| Day 1 (before) | | | | | | | | |
| Basic | 0.9 | 1.0 | 1.4 | 1.2 | 3.5 | 4.1 | 2.0 | 2.0 |
| Advanced | 0.4 | 0.7 | 1.1 | 1.1 | 3.7 | 3.8 | 1.7 | 1.6 |
| Day 2 (before) | | | | | | | | |
| Basic | 0.5 | 0.9 | 1.0 | 1.2 | 3.6 | 3.9 | 1.8 | 1.9 |
| Advanced | 0.3 | 0.6 | 0.9 | 0.9 | 3.1 | 3.8 | 1.4 | 1.5 |
| Day 2 (during) | | | | | | | | |
| Basic | 1.2 | 1.2 | 1.2 | 0.9 | 3.0 | 3.6 | 1.7 | 1.6 |
| Advanced | 0.4 | 0.9 | 0.7 | 0.9 | 3.0 | 3.5 | 1.1 | 1.4 |
| Day 3 (before) | | | | | | | | |
| Basic | 0.4 | 0.4 | 1.0 | 0.8 | 3.6 | 4.3 | 1.6 | 1.2 |
| Advanced | 0.2 | 0.3 | 0.7 | 0.8 | 3.6 | 3.7 | 1.1 | 1.0 |
| Day 3 (during) | | | | | | | | |
| Basic | 0.6 | 0.4 | 1.1 | 0.6 | 3.2 | 4.1 | 1.5 | 0.9 |
| Advanced | 0.3 | 0.4 | 0.6 | 0.5 | 3.4 | 3.8 | 0.9 | 0.7 |
| Significant F (p<0.01) | time | agent x time | time | time | time | time | time | time |
| | experience | | experience | | experience | | experience | |
| | ----- | | ----- | | agent | | ----- | |
| | | | | | ----- | | | |

TABLE 7:

Mean Subjective Risks Associated with the CDTF Exercise and with Parachuting by Subjects Trained with Simulants (Dry Run) and Toxic Agent (Wet Run), Grouped by Type of Course (Basic or Advanced). (0= no risk 10= "the most risky or dangerous activity a person could possibly do").

| | CDTF | | Parachuting | | CDTF/Parachuting | |
|---------------------------------|---------------|--------------|-------------|-------|------------------|-------|
| | Dry | Wet | Dry | Wet | Dry | Wet |
| Day 1 (before) | | | | | | |
| Basic | 2.7 | 4.8 | 6.1 | 5.7 | 0.6 | 0.9 |
| Advanced | 2.3 | 4.0 | 6.5 | 6.2 | 0.4 | 0.7 |
| Day 2 (after) | | | | | | |
| Basic | 1.9 | 3.1 | 6.1 | 5.3 | 0.4 | 0.7 |
| Advanced | 1.8 | 3.2 | 6.3 | 6.2 | 0.3 | 0.6 |
| Day 3 (after) | | | | | | |
| Basic | 1.7 | 2.3 | 6.1 | 5.2 | 0.4 | 0.5 |
| Advanced | 1.6 | 2.8 | 6.3 | 6.1 | 0.3 | 0.5 |
| Significant F ($p < 0.01$) | agent time | time x agent | _____ | _____ | agent time | _____ |

TABLE 8:

Frequency of Incidents Involving Student-initiated Departure from the CDTP by Subjects Trained with Simulants (Dry Run) and Toxic Agent (Wet Run).

DRY RUN (SIMULANTS)

| | |
|------------------------------|--------------------------|
| 3 incidents/260 student days | = 1 per 87 student days |
| Mask fit | 2 |
| Vomiting | 1 |
| Classes included: | 1 each AIT, ANOC, OB, OA |

WET RUN (TOXIC AGENT)

| | |
|---|-------------------------|
| 58 incidents/798 student days | = 1 per 14 student days |
| Mask fit | 37 (64%) |
| Difficult breathing, dizziness, headache, nausea, too hot, etc. | 11 (19%) |
| Torn glove, with or without cut skin | 7 (12%) |
| Panic, refusal to enter | 1 (2%) |
| Back pain | 1 (2%) |
| "Smell agent" | 1 (2%) |

Classes included: senior command (2), OA (2), OB (2), ANOC (2), BNOC (4), AIT (4), EOD (1)

TABLE 9:

Ratings of Confidence in Various Aspects of Chemical Warfare Doctrines, Trainings, and Equipment by Subjects Trained with Simulants (Dry Run) and Toxic Agent (Wet Run), Grouped by Type of Course.

| Question | Advanced Courses | | Basic Courses | |
|---|------------------|----------------|----------------|----------------|
| | WET (N=131) | DRY (N=206) | WET (N=202) | DRY (N=183) |
| 1. Protective clothing | 5.14 | 4.19 | 5.19 | 4.23 |
| 2. Own Training | 4.65 | 3.61 | 4.97 | 4.35 |
| 3. Classmates resistance to panic | 3.59 | 2.73 | 3.23 | 2.67 |
| 4. Own combat performance | 4.49 | 3.72 | 4.50 | 4.01 |
| 5. Classmates combat performance | 4.02 | 3.28 | 4.12 | 3.67 |
| 6. Value of agent training | 5.43 | 4.67 | 5.31 | 4.43 |
| 7. Classmates future teaching | 4.50 | 4.09 | 4.68 | 4.26 |
| 8. Classmates first-aid for chem casualty | 4.21 | 3.40 | 4.34 | 3.99 |
| 9. Classmates detect & identify agents | 4.95 | 4.07 | 5.22 | 4.53 |
| 10. Classmates decontaminate equipment | 4.78 | 3.87 | 5.05 | 4.76 |

Significant ($p < 0.01$) F-ratio: Agent, Course Type, Questions

TABLE 10: Mean Scores of Company-Level Officers and NCOs on Individual Items of the Credibility Questionnaire

| Questions | Mean | Mode | Range of Possible Answer |
|--|------|------|--|
| 1. Toxic agent training would help NCO's train your soldiers? | 4.17 | 6 | 0 = no difference 6 = major improvement |
| 2. Toxic agent training of Chem Corps would improve your unit's survival of chemical weapons attack? | 4.09 | 6 | 0 = no difference 6 = major improvement |
| 3. Toxic agent training of Chem Corps would enhance your unit's overall combat effectiveness? | 4.07 | 6 | 0 = no difference 6 = major improvement |
| 4. Toxic agent training of Chem Corps would increase confidence of your soldiers? | 4.26 | 6 | 0 = no difference 6 = major improvement |
| 5. How much unit training time would you give up for toxic agent training for your soldiers? | 4.01 | 6 | 0 = none 6 = 2 weeks/yr |

TABLE 11: Mean Final Exam Scores on the Chemical Phases of Chemical School Courses by Subjects Training Simulants (Dry Run) and Toxic Agent (Wet Run), Grouped by Type of Course.

| Basic Courses | | Advanced Courses | |
|------------------|--------------------|------------------|--------------------|
| Agent (N=155) | Control (N=455) | Agent (N=111) | Control (N=205) |
| 91.9 | 91.5 | 88.2 | 88.0 |

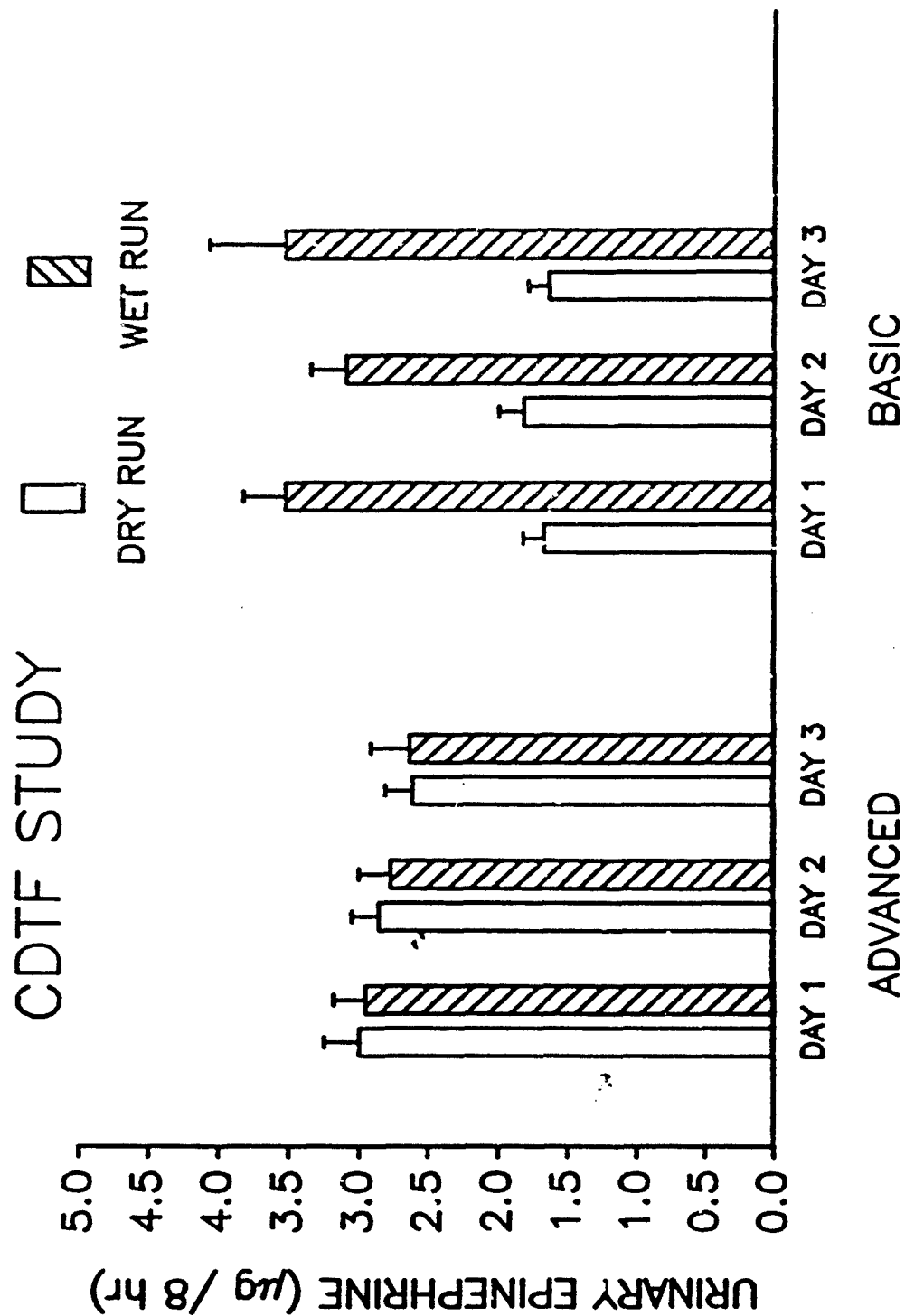
FIGURE LEGENDS

1. Timeline of biomedical and questionnaire stress measures in chemical decontamination training exercises.
2. Effects of chemical decontamination training exercises employing simulants (DRY RUN; n=120) or toxic agents (WET RUN; n=100) on overnight urinary epinephrine and norepinephrine excretion.
3. Effects of chemical decontamination training exercises employing simulants (DRY RUN; n=120) or toxic agents (WET RUN; n=100) on overnight urinary epinephrine excretion in the Chemical School's NCO and officer advanced course (ADVANCED; n=90), and enlisted and officer basic course (BASIC; n=130).
4. Effects of chemical decontamination training exercises employing simulants (DRY RUN; n=103) or toxic agents (WET RUN; n=109) on fear adjective checklist in the Chemical School's NCO and officer advanced course (ADVANCED; n=88), and enlisted and officer basic course (BASIC; n=120).
5. Effects of chemical decontamination training exercises employing simulants (DRY RUN; n=103) or toxic agents (WET RUN; n=105) on risk assessment scale expressed as ratio of perceived risk of CDTF exercise to perceived risk of parachute jumping in the Chemical School's NCO and officer advanced course (ADVANCED; n=88), and enlisted and officer basic course (BASIC; n=120).
6. Ratings of confidence in various aspects of chemical warfare doctrine, training and equipment by chemical school students in courses conducted prior to (CONTROL; n=689) and after (AGENT; n=333) introduction of CDTF toxic agent exercises (see Table 9).
7. Effects of chemical decontamination training exercises on credibility questions 1-4 (Table 10; n=240) expressed as the mean percentage responding at each point along a 6 point scale.
8. Effects of chemical decontamination training exercises on credibility question # 5 (Table 10; n=240) expressed as percentage responding at each point along a 6 point scale.

| | | | | |
|-----------------------|------------------|-------------------|------------------|----------------|
| CDTF | | | | |
| DAY 1 / DAY 2 / DAY 3 | | | | |
| 4 - 8 WEEKS | SAFETY BRIEF. | SIMULANT DRILL | SAFETY BRIEF. | AGENT DRILL |
| | ● | ● | ● | ● |
| | ▲ | ▲ | ▲ | ▲ |
| | ★ | ★ | ★ | ★ |

*** URINE (OVERNIGHT)**

Figure 2



Significant F ($p < .01$) for agent, agent \times experience

Figure 3

CDTF STUDY

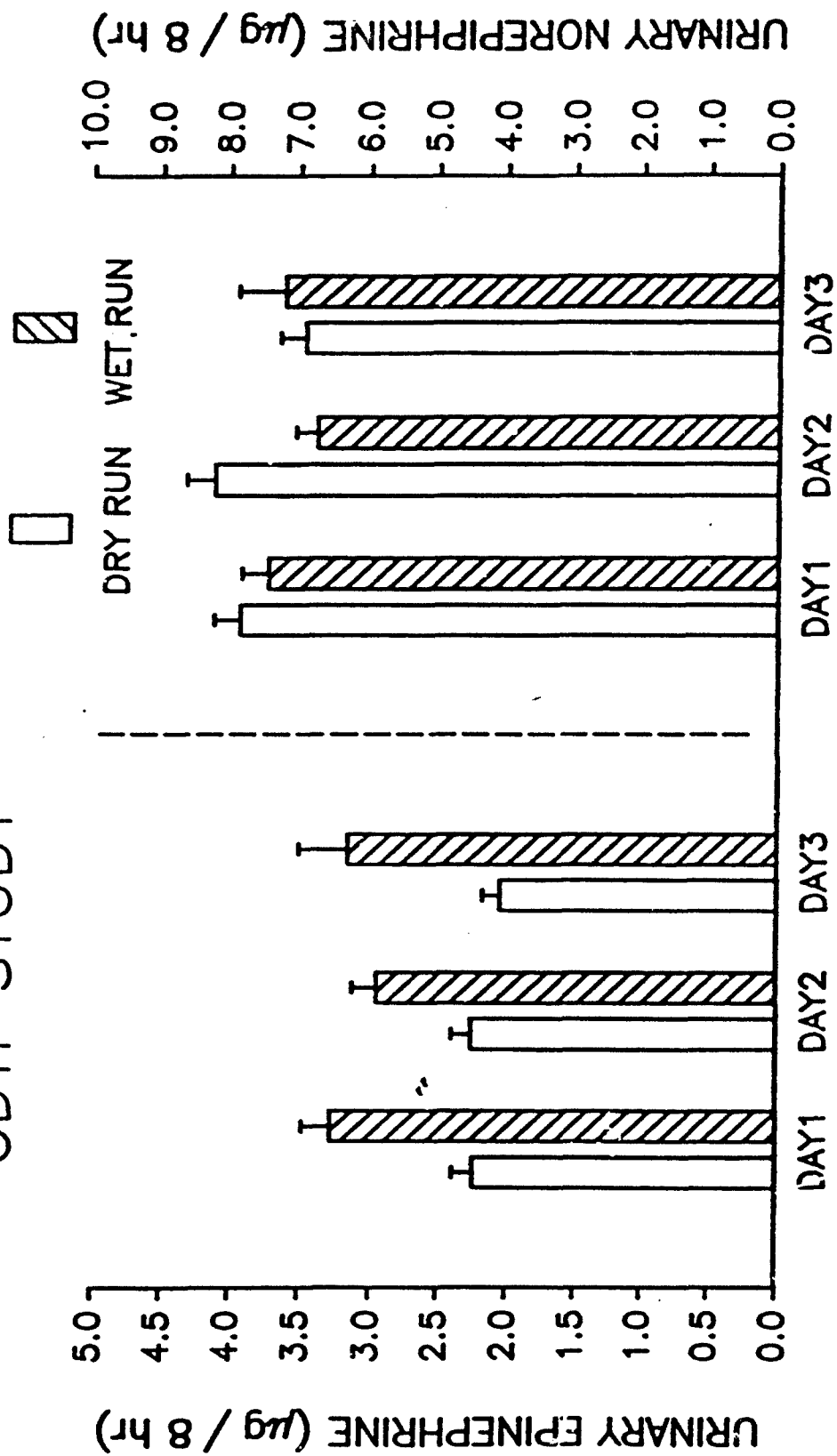


Figure 4

FEAR RATINGS

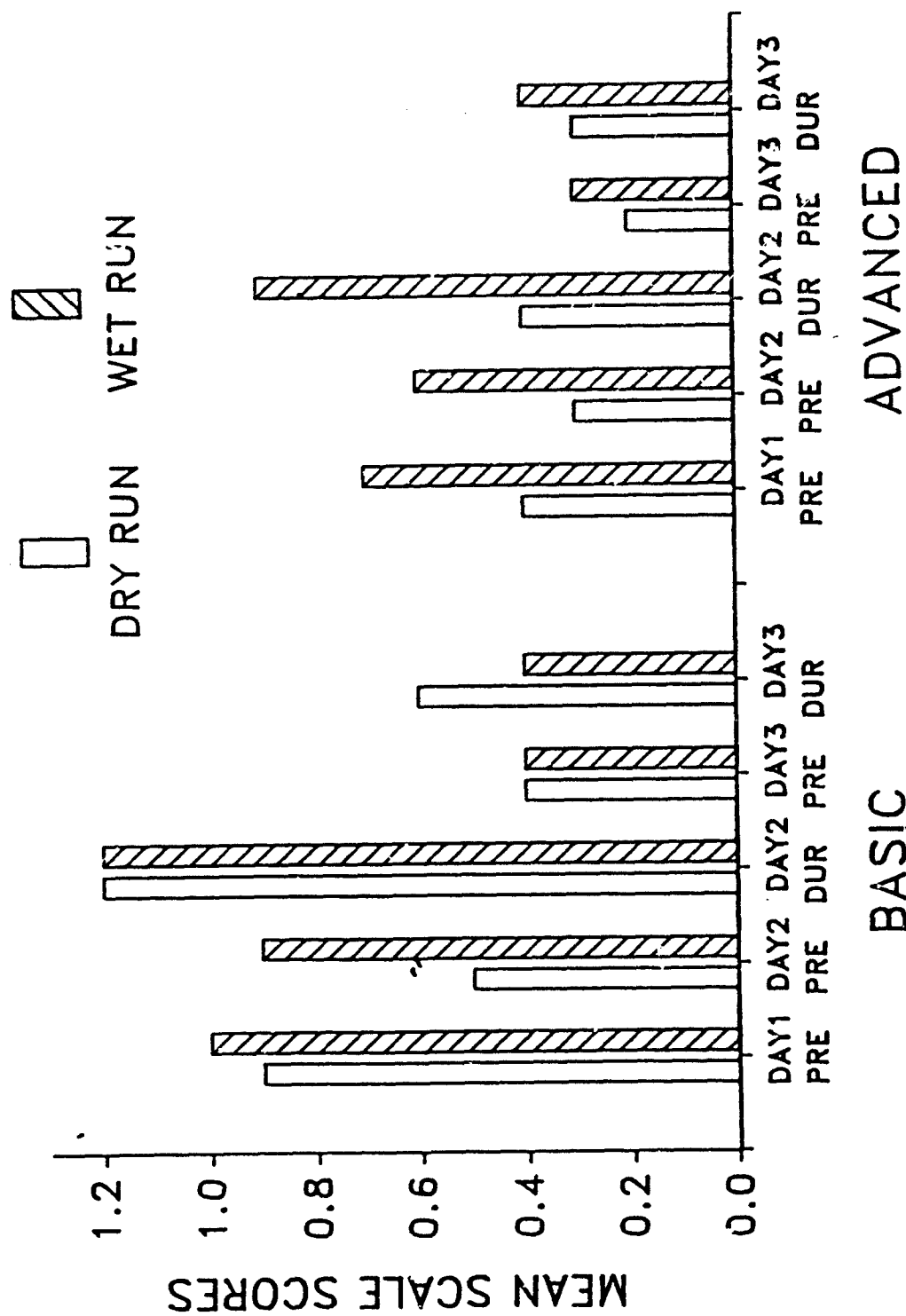


Figure 5

CDTF/PARACHUTING RISK ASSESSMENT

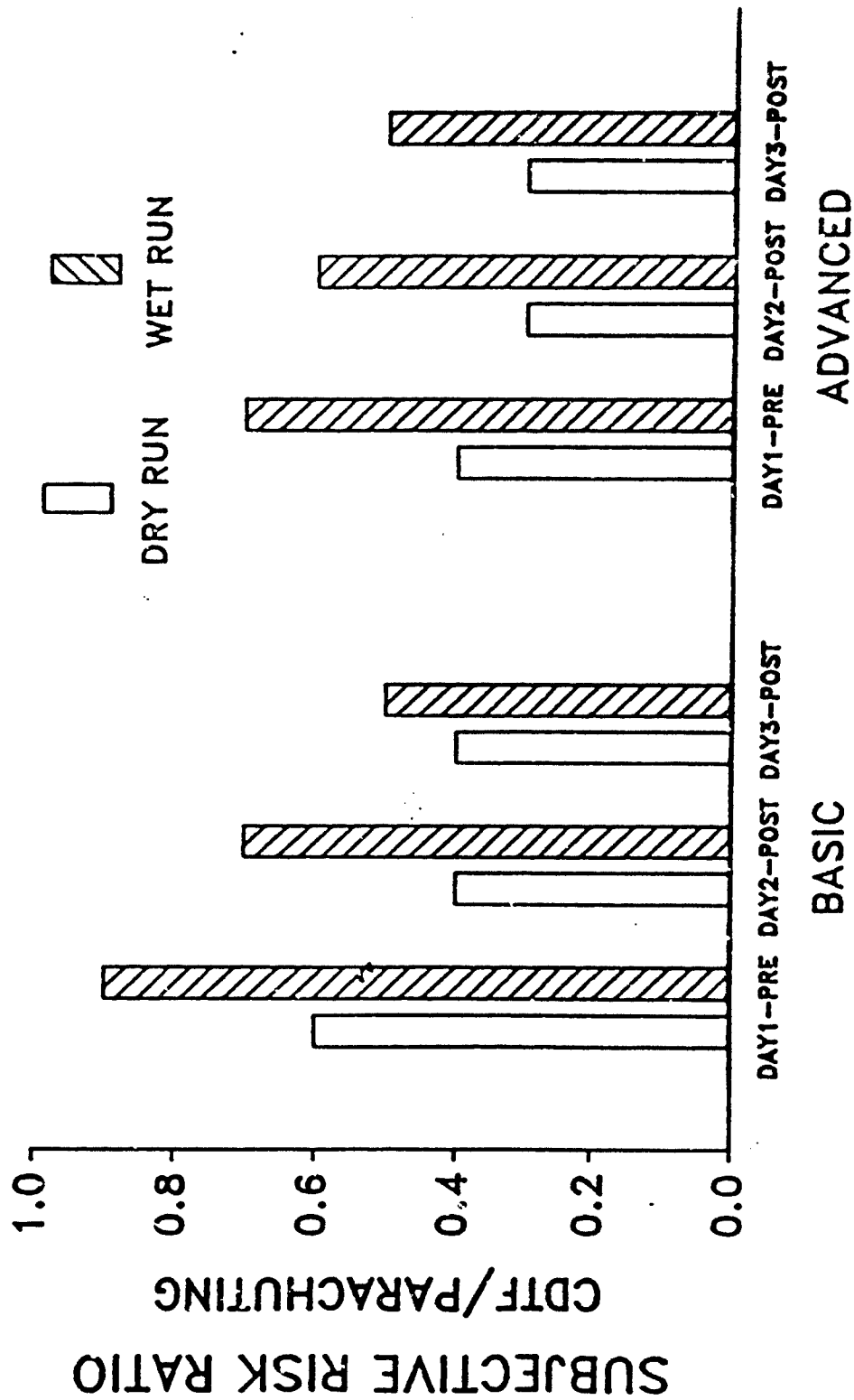


Figure 6

CONFIDENCE QUESTIONNAIRE

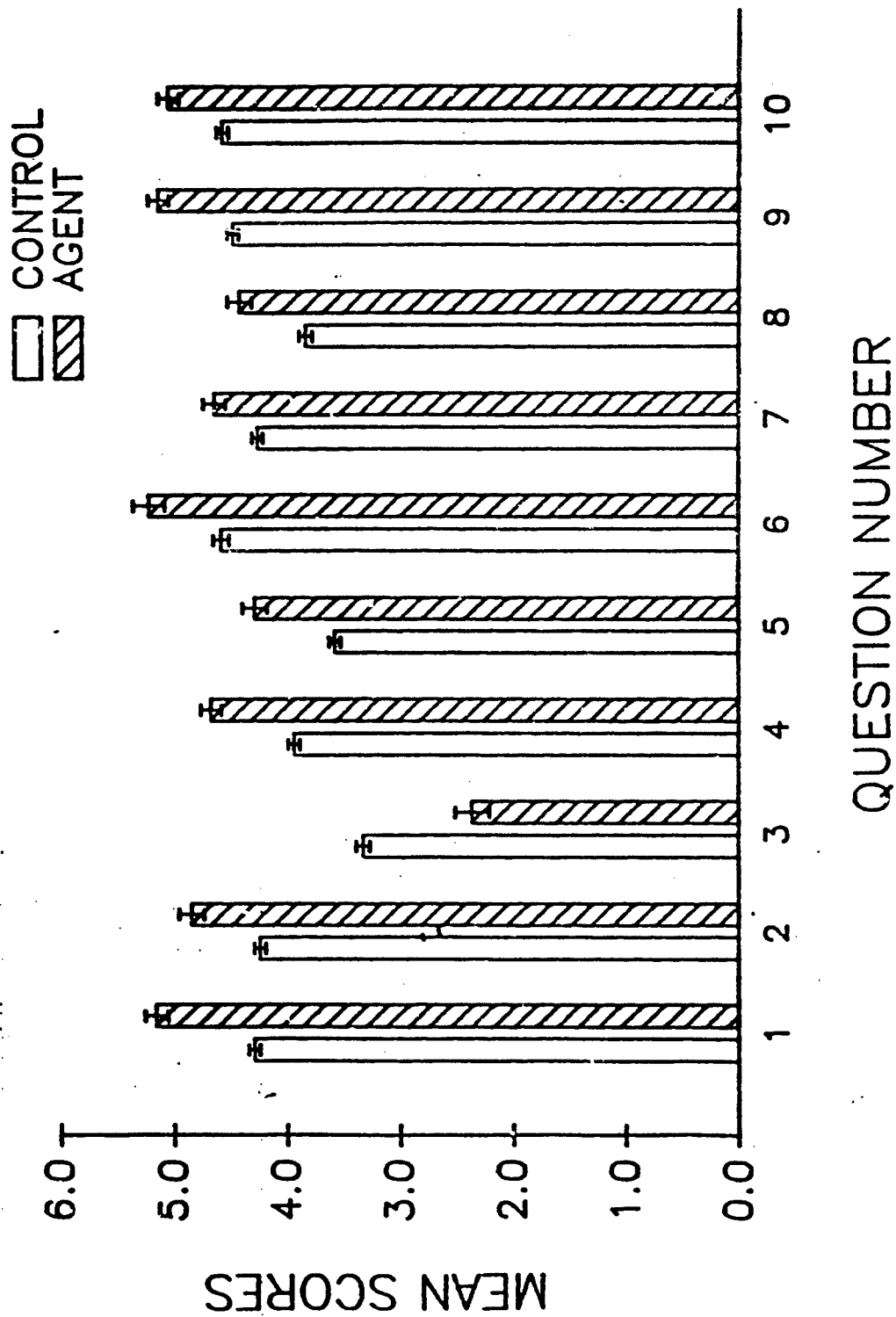
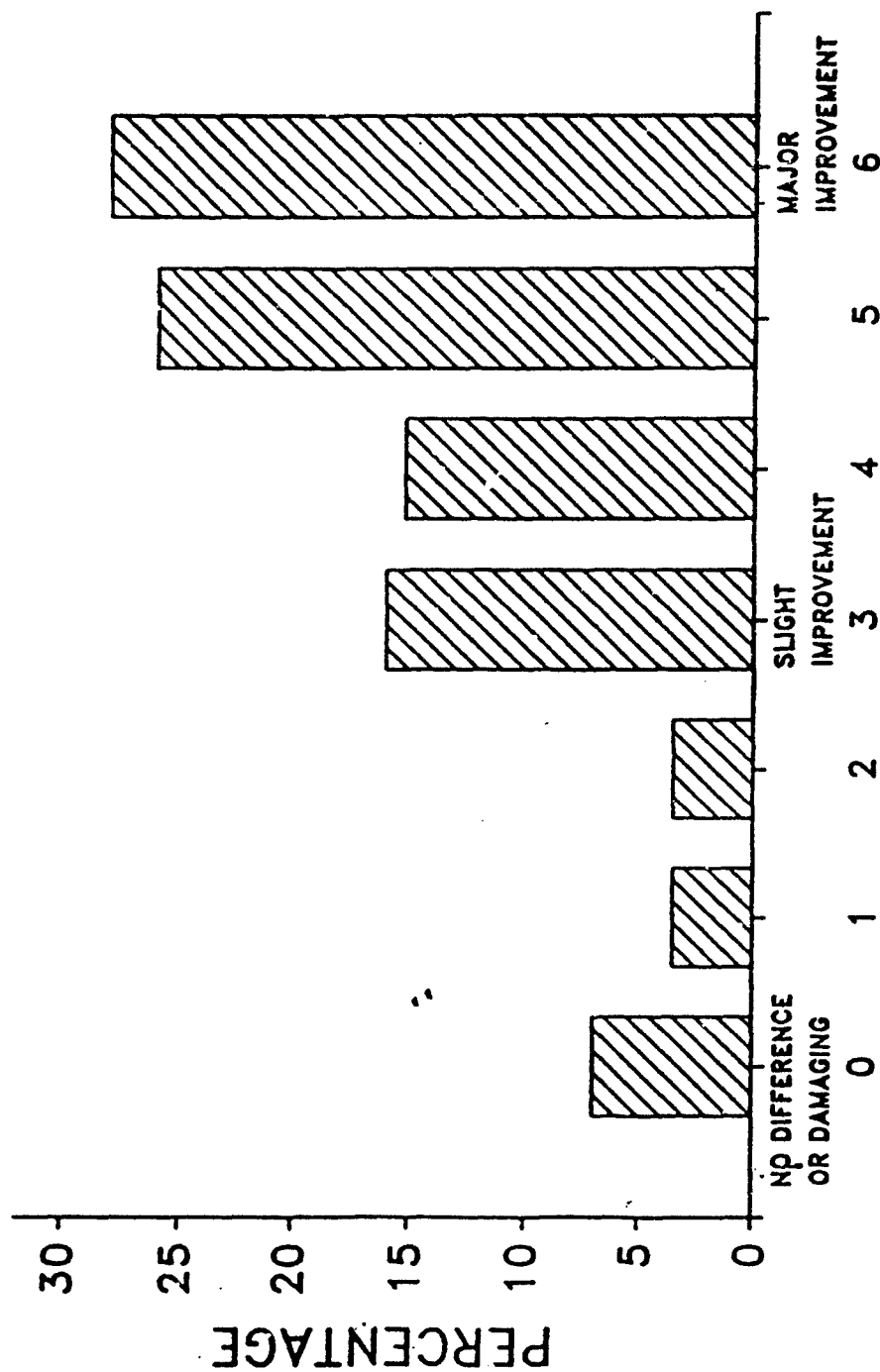


Figure 7

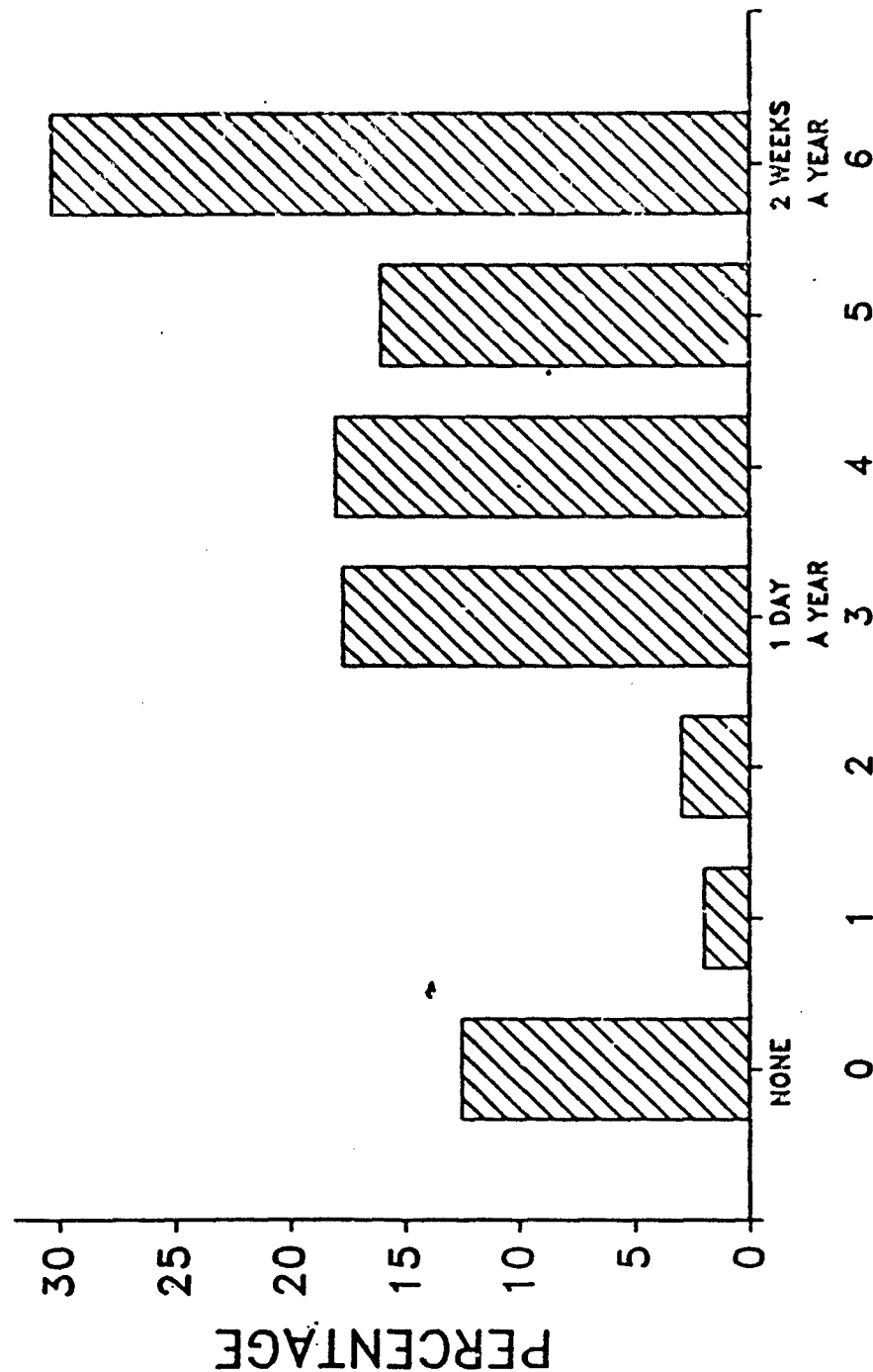
CREDIBILITY QUESTIONNAIRE



"WOULD CHEMICAL CORPS NCO'S AND OFFICERS TRAINED WITH LIVE AGENT
ENHANCE THE OVERALL COMBAT EFFECTIVENESS OF YOUR UNIT?"

Figure 8

CREDIBILITY QUESTIONNAIRE



"HOW MUCH OF YOUR UNIT'S TRAINING TIME WOULD YOU GIVE UP TO OBTAIN LIVE AGENT'S TRAINING FOR YOUR SOLDIERS?"

APPENDIX I
CONFIDENCE QUESTIONNAIRE

Please answer each question by circling the number, from zero to six, which best shows your opinion.

1. How will MOPP IV (mask, suit, gloves, boots) protect you during a chemical attack in combat?

| | | | | | | |
|-----------------|----------|----------|----------|----------|----------|--------------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| Quite Poorly | | | | | | Very Well |

2. How has your training prepared you to perform in a chemical attack in combat?

| | | | | | | |
|-----------------|----------|----------|----------|----------|----------|--------------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| Quite Poorly | | | | | | Very Well |

3. How many of your Ft. McClellan classmates will panic the first time they face a major chemical attack?

| | | | | | | |
|-------------------|----------|----------|----------|----------|----------|---------------------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| Hardly Anybody | | | | | | Nearly Everybody |

4. How would you perform your mission in MOPP IV during a chemical war?

| | | | | | | |
|-----------------|---|---|---|---|---|--------------|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| Quite Poorly | | | | | | Very Well |

5. How do you think your Ft. McClellan classmates will perform their assignments in MOPP IV during a chemical war?

| | | | | | | |
|-----------------|----------|----------|----------|----------|----------|--------------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| Quite Poorly | | | | | | Very Well |

6. What do you think of the value of using actual chemical warfare agents such as GB or VX in Army training?

| | | | | | | |
|---------------------|----------|----------|----------|----------|----------|-----------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| Nearly Worthless | | | | | | Essential |

7. How effectively will your classmates instruct soldiers outside the Chemical Corps to operate successfully on a chemical battlefield?

| | | | | | | |
|-----------------|----------|----------|----------|----------|----------|--------------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| Quite Poorly | | | | | | Very Well |

HOW WOULD YOUR FT. MCCLELLAN CLASSMATES PERFORM THE FOLLOWING TASKS WHILE IN MOPP IV DURING COMBAT?:

8. Provide first-aid if you became a chemical casualty?

| | | | | | | |
|-----------------|----------|----------|----------|----------|----------|--------------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| Quite Poorly | | | | | | Very Well |

9. Identify different chemical agents?

| | | | | | | |
|-----------------|----------|----------|----------|----------|----------|--------------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| Quite Poorly | | | | | | Very Well |

10. Decontaminate equipment you would later use?

| | | | | | | |
|-----------------|----------|----------|----------|----------|----------|--------------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| Quite Poorly | | | | | | Very Well |

Please indicate whether you are male (M) or female (F)

APPENDIX 2

CREDIBILITY QUESTIONNAIRE

Please answer each question by circling the number from zero to six which best shows your opinion.

CHEMICAL CORPS PERSONNEL WILL SOON BEGIN OCCASIONAL TRAINING EXERCISES WITH LIVE CHEMICAL AGENTS ("NERVE GAS"). PLEASE ANSWER THESE QUESTIONS IN TERMS OF YOUR MOST RECENT COMBAT ARMS ASSIGNMENT.

1. Would Chemical Corps NCO's trained with live agent do a better job of training your soldiers to fight on a chemical battlefield?

| | | | | | | |
|------------------------------|----------|----------|-----------------------|----------|----------|----------------------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| no difference or damaging | | | slight improvement | | | major improvement |

2. Would Chemical Corps NCO's and officers trained with live agent improve the chance of your unit surviving a first attack with chemical weapons?

| | | | | | | |
|------------------------------|----------|----------|-----------------------|----------|----------|----------------------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| no difference or damaging | | | slight improvement | | | major improvement |

3. Would Chemical Corps NCO's and officers trained with live agent enhance the overall combat effectiveness of your unit?

| | | | | | | |
|------------------------------|----------|----------|-----------------------|----------|----------|----------------------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| no difference or damaging | | | slight improvement | | | major improvement |

4. Would Chemical Corps NCO's and officers trained with live agent increase the confidence of soldiers in your unit?

| | | | | | | |
|------------------------------|----------|----------|-----------------------|----------|----------------------|----------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| no difference or damaging | | | slight improvement | | major improvement | |

5. How much of your unit's training time would you give up to obtain live agent training for your soldiers?

| | | | | | | |
|----------|----------|----------|-------------------|----------|---------------------|----------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| none | | | one day a year | | two weeks a year | |

6. How would your soldiers respond if they faced a major chemical attack — today?

| | | | | | | |
|------------------------|----------|----------|-----------------------|----------|-----------------------|----------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| Panic, Unit breakup | | | Moderate Confusion | | Minimal Disruption | |

7. If your unit survived a major chemical attack, today, how effectively could it fight afterward in MOPP IV on a dirty battlefield?

| | | | | | | |
|----------------------|----------|----------|-------------------------|----------|----------------------|----------|
| <u>0</u> | <u>1</u> | <u>2</u> | <u>3</u> | <u>4</u> | <u>5</u> | <u>6</u> |
| Barely Functional | | | Moderately Effective | | Highly Successful | |

What is your rank?

What is your branch?

What is your current assignment?

APPENDIX 3a
MCOD QUESTIONNAIRE

Last four SSN digits:

Dates:

Class: E10 NCO OB OA

Sessions: 1A 1B 2A 2B 3A 3B

For each word, please circle the number beside it which best shows how well that word
DESCRIBES YOUR FEELINGS RIGHT NOW.

| | Not At All | | | | | | Very Much So |
|-----------|---------------|---|---|---|---|---|-----------------|
| MISERABLE | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| UNEASY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| INACTIVE | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| ENERGETIC | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| BLUE | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| GROUCHY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| LIVELY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| GOOD | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| MEAN | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| ANNOYED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| DEPRESSED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| ALARMED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| INSECURE | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| WEARY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| ALERT | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| LAZY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| CONTENTED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| CHEERFUL | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| SAD | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| DOWNCAST | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| SATISFIED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| ANGRY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| LOW | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| AFRAID | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

| | Not At All | | | | | | Very Much So |
|-----------|------------|---|---|---|---|---|--------------|
| BURNED UP | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| DROWSY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| CALM | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| IRRITATED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| JITTERY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| VIGOROUS | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| PLEASED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| ACTIVE | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| HAPPY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| STEADY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| HOPELESS | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| SLUGGISH | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

How well did you sleep last night?

| | | | | | | |
|----------------------|---|---|-------------------|---|---------------------|---|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| very badly for me | | | average for me | | very well for me | |

Please imagine the MOST RISKY OR DANGEROUS activity a person could possibly do. Think of that activity as one end of the scale below, and a completely no-risk activity as the other end. Please mark the letter "P" below the number which best shows how risky you think PARACHUTE JUMPING is. Please mark the letter "C" below the number which best shows how risky you think this week's CDTF exercise is.

| | | | | | | | | | | |
|-------------------|---|---|---|---|---|---|---|---|---|----|
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| No risk at all | | | | | The most risky activity I can imagine | | | | | |

APPENDIX 3b
MOOD QUESTIONNAIRE

Last four SSN digits:

Date:

Class: E10 NCO OB OA

Sessions: 1A 1B 2A 2B 3A 3B

For each word, please circle the number beside it which best shows how well that word DESCRIBES YOUR FEELINGS IN THE MASK CHECK ROOM AND DURING YOUR FIRST FEW MINUTES IN THE FACILITY'S "HOT" AREA.

| | Not At All | | | | | | Very Much So |
|-----------|---------------|---|---|---|---|---|-----------------|
| MISERABLE | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| UNEASY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| INACTIVE | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| ENERGETIC | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| BLUE | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| GROUCHY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| LIVELY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| GOOD | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| MEAN | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| ANNOYED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| DEPRESSED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| ALARMED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| INSECURE | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| WEARY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| ALERT | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| LAZY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| CONTENTED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| CHEERFUL | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| SAD | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| DOWNCAST | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| SATISFIED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| ANGRY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| LOW | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| AFRAID | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

| | Not At All | | | | | | Very Much So |
|-----------|---------------|---|---|---|---|---|-----------------|
| BURNED UP | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| DROWSY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| CALM | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| IRRITATED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| JITTERY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| VIGOROUS | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| PLEASED | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| ACTIVE | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| HAPPY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| STEADY | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| HOPELESS | 0 | 1 | 2 | 3 | 4 | 5 | 6 |
| SLUGGISH | 0 | 1 | 2 | 3 | 4 | 5 | 6 |

How well did you sleep last night?

0 1 2 3 4 5 6

very badly
for me

average
for me

very well
for me

Please imagine the MOST RISKY OR DANGEROUS activity a person could possibly do. Think of that activity as one end of the scale below, and a completely no-risk activity as the other end. Please mark the letter "P" below the number which best shows how risky you think PARACHUTE JUMPING is. Please mark the letter "C" below the number which best shows how risky you think this week's CDTF exercise is.

0 1 2 3 4 5 6 7 8 9 10

No risk
at all

The most
risky activity
I can imagine

VOLUNTEER AGREEMENT AFFIDAVIT

For use of this form, see AR 40-38; the processing agency is the Office of the Surgeon General

THIS FORM IS AFFECTED BY THE PRIVACY ACT OF 1974

1. AUTHORITY: 10 USC 3012, 44 USC 1101 and 10 USC 1071-1087.

2. PRINCIPAL PURPOSE: To document voluntary participation in the Clinical Investigation and Research Program. SSN and home address will be used for identification and locating purposes.

3. ROUTINE USES: The SSN and home address will be used for identification and locating purposes. Information derived from the study will be used to document the study; implementation of medical programs; teaching; adjudication of claims; and for the mandatory reporting of medical conditions as required by law. Information may be furnished to Federal, State and local agencies.

4. MANDATORY OR VOLUNTARY DISCLOSURE: The furnishing of SSN and home address is mandatory and necessary to provide identification and to contact you if future information indicates that your health may be adversely affected. Failure to provide the information may preclude your...

PART A - VOLUNTEER AFFIDAVIT

VOLUNTEER SUBJECTS IN APPROVED DEPARTMENT OF THE ARMY RESEARCH STUDIES

Volunteers under the provisions of AR 70-25 are authorized all necessary medical care for injury or disease which is the proximate result of their participation in such studies.

I, _____ SSN _____ having
(last, first, middle)

full capacity to consent and having attained my _____ birthday, do hereby volunteer to participate in
An Evaluation of Stress, Confidence and Performance Associated with the USA Chemical
School's Decontamination Training Facility

under direction of C. FREDERICK TYNER, COL, MC conducted at FT. MCCLELLAN, AL

(name of institution)

The implications of my voluntary participation; the nature, duration and purpose of the research study; the methods and means by which it is to be conducted; and the inconveniences and hazards that may reasonably be expected have been explained to me by C. Frederick Tyner, COL, Dir, Div of Neuropsychiatry, WRATR/WRAMC, Wash., DC 20307-5100
(202) 576-3556, 3006 (AV 291-3556/3006).

I have been given an opportunity to ask questions concerning this investigational study. Any such questions were answered to my full and complete satisfaction. Should any further questions arise concerning my rights on study-related injury I may contact

JUDGE ADVOCATES OFFICE

at FT. MCCLELLAN, AL 36205-5020 (205) 238-5435 (AV 865-5435)

(name and address of hospital - phone number (include area code))

I understand that I may at any time during the course of this study revoke my consent and withdraw from the study without further penalty or loss of benefits however, I may be ☐ required (military orders) or ☐ requested (civilian orders) to undergo certain examination if, in the opinion of the attending physician, such examinations are necessary for my health and well-being. My refusal to participate will involve no penalty or loss of benefits to which I am otherwise entitled.

PART B - TO BE COMPLETED BY INVESTIGATOR

INSTRUCTIONS FOR ELEMENTS OF INFORMED CONSENT: (Provide a detailed explanation in accordance with Appendix E, AR 40-38 or AR 70-25.)

1. The purpose of this research is to assess the stressfulness and effectiveness of the three day training exercise at the Chemical Decontamination Training Facility. The research is not part of the actual CDTF training. Therefore, should you refuse to consent, you still will be required to complete the scheduled CDTF training on the course POI. You will not, however, be involved in the additional medical research studies described here, which will accompany portions of the training.

2. Volunteering to participate in this study will involve the following:

- i. answering questionnaires (8 times in three days).
- ii. having your heart rate and blood pressure measured (8 times in three days).
- iii. giving an overnight urine specimen (before each of the three days).
- iv. giving one tube (10 c.c's) of blood (5 times in three days).
- v. wearing a heart rate monitor (all morning for the three mornings).
- vi. wearing an activity monitor (for 6 days before and during the training).

3. The information gathered from this study will allow the investigators to analyze psychological, physiological and hormonal factors involved in the normal response of healthy soldiers to a training exercise involving chemical warfare agents. Previous studies have shown that situations such as this are associated with changes in heart rate, blood pressure and the release of hormones.

4. There is a small risk of hypotension (decrease in blood pressure) resulting in passing out or fainting during insertion of the needle for the blood sample. This usually is self limited with no serious adverse emergencies. You are not expected to suffer any major discomforts beyond a possible hematoma (bruise or temporary black and blue mark) or minor infection at the site of insertion of the intravenous needle. No precautions need to be observed before or after the study with the exception that persistent redness or tenderness the insertion site should be examined by a physician for possible infection.

5. You may not benefit directly from this study but the study may contribute to more effective training for future students in the Chemical School. The time spent in support of this project will be recognized through a letter of appreciation.

6. You are expected to inform the principal investigators if you have any medical problems or are taking any medication. Individuals with medical problems or who are taking medications or drugs which might interfere with interpreting the test results will be excluded from the study.

7. You should understand that participation in this study is voluntary and if you refuse to enroll or decide to leave the study at any time, this will no way count against you or have any effect on your graduation from this course. If you decide to withdraw from the study, you are expected to inform the principal investigator directly. Such withdrawal removes you only from the medical research aspects described above. It does not remove you from the actual CDTF training itself. That training is a requirement for graduation from your course of instruction.

8. Confidential records will be available only to the investigators actively participating in the study and representatives of the U.S. Army Research and Development Command. In all publications and presentations resulting from this research study, no reference will be made to you and your identity will be treated as medically confidential.

9. This study will consist of approximately 300 volunteers.

Signature

Date